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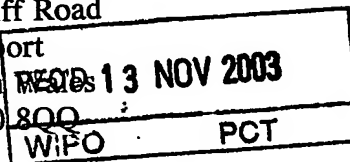
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P01/7700 0.00-0218674.0**Request for grant of a patent**

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NP10 8QQ**1. Your reference**

P31562-/MHR/CC1/GEM

2. Patent application number

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0218674.0

3. Full name, address and postcode of the or of each applicant (underline all surnames)Mr Andrew J Boulton
5 Clarendon Road
Linthgow
Lothian
EH49 6AN

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

77590 46001

4. Title of the invention

"Improvements in or Relating to Internal Combustion Engines"

5. Name of your agent (if you have one)

Murgitroyd & Company

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Scotland House
165-169 Scotland Street
Glasgow
G5 8PL

Patents ADP number (if you know it)

1198015

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)Date of filing
(day / month / year)**7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application**

Number of earlier application

Date of filing
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No

- a) any applicant named in part 3 is not an inventor, or
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Continuation sheets of this form

Description 24

Claim(s)

Abstract

Drawing(s) 6

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Murgitroyd & Company

Date

12 August 2002

Murgitroyd & Company

12. Name and daytime telephone number of person to contact in the United Kingdom

Edward Murgitroyd

0141 307 8400

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1 **Improvements in or Relating to Internal Combustion**
2 **Engines**

3
4 This invention relates to improvements in or
5 relating to internal combustion engines, and in
6 particular, but not exclusively, to improvements
7 relating to replacement apparatus for the intake and
8 exhaust valves of internal combustion engines.

9
10 Conventional four stroke internal combustion engines
11 involve a four stage cycle. Firstly, there is an
12 intake of air/fuel mixture into a cylinder; known as
13 "intake stroke". Secondly, a piston within the
14 cylinder compresses the air/fuel mixture; known as
15 "compression stroke". Thirdly, the compressed
16 air/fuel mixture is ignited in the cylinder causing
17 combustion; known as "combustion stroke". And
18 lastly, the combusted gases are exhausted; known as
19 "exhaust stroke".

20
21 A four stroke internal combustion engine comprises
22 an intake valve to allow an ingress of air/fuel

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1 mixture into a cylinder, and an exhaust valve, to
2 allow an egress of exhausted gases after combustion.
3 of the air/fuel mixture.

4
5 The timing of the opening and closing of the valves
6 is vital to an engines performance.

7

8 To allow the piston to draw-in the fuel/air mixture,
9 the intake valve needs to open as the piston moves
10 from an extended position to a retracted position on
11 the intake stroke.

12

13 The exhaust valve needs to be opened as the piston
14 is extended in the exhaust stroke.

15

16 Both the intake and the exhaust valves each comprise
17 a rocker arm and a valve return spring, with the
18 rocker arm being actuated by a cam or a lobe located
19 on a camshaft.

20

21 The valves act against the valve return springs,
22 where the valves are fired in one direction, only
23 then to stop at the extent of their travel, and be
24 sent flying in the opposite direction. This happens
25 many times a minute which wastefully drains power
26 from the engine. This also causes noise, vibration
27 and harshness.

28

29 As the camshaft rotates, the shape of the cam which
30 actuates the rocker arm, determines the timing of
31 the opening and closing of the intake and exhaust
32 valves.

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1 Conventional designs of cams, particularly fixed
2 cams, will only operate optimally for a given range
3 of speeds.

4
5 According to an aspect of the present invention
6 there is provided a cylinder head assembly
7 comprising a cylinder head having an inlet passage
8 and an outlet passage to and from a cylinder, and at
9 least one rotatably mounted shaft member interposed
10 between the inlet and outlet passages and the
11 cylinder, the shaft member having a recess to allow
12 an ingress of air/fuel mixture from the inlet
13 passage to the cylinder at a first desired
14 rotational position, and to allow an egress of
15 combusted gases from the cylinder through the outlet
16 passage at a second desired rotational position and
17 to prevent the air/fuel mixture or combusted gases
18 from entering or exiting the cylinder at a third
19 desired rotational position.

20
21 Preferably, the shaft member is substantially solid.

22
23 Alternatively, the shaft member may be hollow.

24
25 Preferably, there is one shaft member interposed
26 between the inlet and outlet passages and the
27 cylinder.

28
29 Alternatively, there may be two shaft members; one
30 for the ingress of air/fuel mixture and having one
31 recess, and the other for the egress of combusted
32 gases and having one recess.

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1 Preferably, the shaft member(s) may be extended over
2 a number of cylinders, the shaft member(s) having a
3 corresponding number of recesses.

4
5 Preferably, the shaft member(s) have gas tight seal
6 assemblies.

7
8 According to a further aspect of the present
9 invention there is provided a cylinder head assembly
10 comprising a cylinder head having a hollow inlet
11 shaft member and outlet shaft member rotatably
12 mounted; each shaft member having at least one
13 aperture located around a portion of its
14 circumference, wherein the inlet shaft member allows
15 an ingress of air/fuel mixture from the inlet shaft
16 member to enter said cylinder when the aperture in
17 the inlet shaft is presented to the cylinder, and
18 the outlet shaft member allows an egress of
19 combusted gases to exit the cylinder when the
20 aperture in the outlet shaft member is presented to
21 the cylinder.

22
23 Preferably, the inlet and outlet shaft members may
24 be extended over a number of cylinders, the inlet
25 and outlet shaft members having a corresponding
26 number of recesses.

27
28 Preferably, the inlet and outlet shaft members have
29 gas tight seal assemblies.

30
31 Preferably, each shaft member comprises an inner
32 hollow tube member rotatably mounted within the

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1 hollow inlet and outlet shaft members which are also
2 rotatably mounted; each inner tube member having at
3 least one aperture located around a portion of its
4 circumference; rotation of said inner tube member
5 within the hollow inlet and outlet shaft members
6 respectively provides a variable size effective
7 aperture, which allows a variable ingress of
8 air/fuel to enter said cylinder through the
9 effective aperture in the inlet shaft member, and
10 allows a variable egress of combusted gases from the
11 cylinder to exit through the effective aperture in
12 the outlet shaft member.

13
14 Preferably, the speed of rotation of the inner and
15 outer tube members are such that the effective
16 aperture maximises or restricts the rate of ingress
17 of air/fuel mixture; or egress of exhaust gases,
18 through the respective inner tube members.

19
20 Preferably, the inner tube members are coupled to a
21 crankshaft with means for independently controlling
22 or adjusting the speed of rotation of said tube
23 members.

24
25 Alternatively, the tube members may be independently
26 driven from the crankshaft, and from each other,
27 with means for individually controlling or adjusting
28 the speed of rotation of said tube members.

29
30 Preferably, the shaft members may be extended over a
31 number of cylinders, the shaft members and inner
32 tube members having a corresponding number of

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1 apertures.

2

3 Preferably, the shaft members have gas tight seal
4 assemblies.

5

6 According to yet still a further aspect of the
7 present invention there is provided a method of
8 allowing an ingress and egress of an air/fuel
9 mixture and combusted gases from a cylinder
10 comprising the steps of:

11

12 presenting a recess within a shaft member to an
13 inlet passage;

14

15 retraction of a piston within a cylinder to
16 allow an in-take of air/fuel mixture from the
17 inlet passage into the shaft member;

18

19 the shaft member rotating to prevent any
20 leakage of air/fuel mixture upon a compression
21 of the air/fuel mixture in the cylinder by the
22 piston;

23

24 combustion of air/fuel mixture causing said
25 piston to retract;

26

27 the shaft member rotating further, continuing
28 to prevent any leakage of resultant combusted
29 gases;

30

31 piston extending in the cylinder;

32

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1 the shaft member rotating to present the recess
2 to the cylinder and an outlet passage to allow
3 an egress of combusted gases; and
4
5 repetition of the above steps.

6
7 Preferably, the recess is an aperture in a hollow
8 shaft and the method further includes the step of
9 varying the effective aperture to restrict or
10 maximise the amount of fluid flow through the
11 aperture.

12
13 Embodiments of the present invention will now be
14 described, by way of example only, with reference to
15 the accompanying drawings in which:-

16
17 Fig. 1 is a schematic front sectional view of a
18 conventional four stroke internal combustion
19 engine;

20 Figs. 2a-d are schematic front sectional views
21 illustrating the workings of a single rotatably
22 mounted shaft member of the present invention;

23
24 Figs. 3a-d are schematic front sectional views
25 illustrating the workings of an alternative
26 embodiment with two rotatably mounted shaft
27 members;

28
29 Figs. 4a and 4b are a side view and perspective
30 side view respectively (shown schematically) of
31 an alternative shaft member;

32

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1 Fig. 5 is a schematic plan view of further
2 alternative shaft members;

3

4 Fig. 6 is a schematic plan view of shaft member
5 embodiments applied to more than one cylinder;

6

7 Fig. 7 is a schematic perspective view of
8 apparatus of a first embodiment;

9

10 Fig. 8 is a schematic perspective view of
11 apparatus of a second embodiment; and

12

13 Fig. 9 is a schematic perspective view of
14 apparatus of a third and fourth embodiment;

15

16 With reference to the drawings, and in particular
17 Fig. 1, there is provided conventional apparatus of
18 a four stroke internal combustion engine 10.

19

20 The conventional engine 10 comprises the known
21 element of a cylinder 12 which houses a piston M
22 which is movably sealed therein.

23

24 The piston M is attached to a crankshaft P by a
25 connecting rod N and rod bearing O. The crankshaft
26 P serves to convert the up and down motion of the
27 piston M into rotational motion; which is utilised
28 to turn wheels of a vehicle, propellers of a vessel
29 or aircraft.

30

31 The conventional engine 10 also comprises the known
32 element of a cylinder head D having an intake valve

1 assembly A and an exhaust valve assembly J which are
2 both intermittently actuated by a camshaft I.
3 Both valve assemblies A, J have rocker arms 14, 18
4 with corresponding springs 16, 20, and conventional
5 poppet valves 22, 24.

6
7 On the intake stroke of a four stroke engine 10, the
8 intake valve assembly A is open to allow an ingress
9 of air/fuel mixture into the cylinder 12 via an
10 intake port C.

11
12 Meanwhile, the exhaust valve assembly J is closed.
13 The piston M will retract drawing the air/fuel
14 mixture into the cylinder 12.

15
16 The piston M retracts by virtue of stored energy
17 being transferred from a flywheel (not shown) to the
18 piston M via the crankshaft P.

19
20 It should be understood that on all "non-power
21 strokes", namely, retraction of the piston M on the
22 intake stroke, compression of the air/fuel mixture,
23 and exhausting of the combusted gases, the energy
24 required to drive the piston M is transferred from
25 the flywheel to the connected crankshaft P.

26
27 As the piston M bottoms out it will change direction
28 and extend within the cylinder 12. Closure of the
29 intake valve assembly A allows for the air/fuel
30 mixture to be compressed within the cylinder 12;
31 referred to as "compression stroke".

32

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10

1 Again, the exhaust valve assembly J is closed.

2

3 When fully compressed, a spark plug K extending into
4 the cylinder 12, ignites the compressed mixture to
5 cause combustion.

6

7 Alternatively, in a diesel engine, the heat caused
8 by compressing the air/fuel mixture alone will
9 result in combustion.

10

11 The resultant combustion produces an excess of gases
12 which force the piston M to retract within the
13 cylinder 12.

14

15 The exhaust valve assembly J is opened as the piston
16 M bottoms out to allow an egress of the combusted
17 gases through an exhaust port L: referred to as
18 "exhaust stroke".

19

20 As the piston M returns to an extended position, the
21 exhaust valve assembly J is closed, whereas the
22 intake valve assembly A is open to start the cycle
23 again and allow in ingress of air/fuel mixture.

24

25 It will be realised that the timing of the opening
26 and closing of the valve assemblies A, J will have a
27 large bearing on the performance of the engine 10.

28

29 If either of the valve assemblies A, J are open on
30 the compression stroke, then the air/fuel mixture
31 will not be fully compressed resulting in poor
32 performance of the engine 10.

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1 Lobes or cams 26 located on the camshaft I are
2 designed to intermittently open and close each of
3 the valve assemblies A, J as and when required.

4
5 It will be realised however, that (fixed) cams 26 of
6 a particular design operate optimally for a given
7 range of speeds only.

8
9 The rocker arms 14, 18 act against the corresponding
10 valves 22, 24 and valve return springs 20, 16. The
11 valves 22, 24 are fired in one direction, only then
12 to stop at the extent of their travel, and be sent
13 flying in the opposite direction. This happens many
14 times a minute which wastefully drains power from
15 the engine 10 and can cause noise, vibration and
16 harshness.

17
18 In a first embodiment of the present invention, as
19 illustrated in Figs. 2a-d and Fig. 7, there is
20 provided apparatus 100 in the form of a cylinder
21 head assembly comprising a cylinder head D adapted
22 with a valve assembly replacement shaft member 110
23 rotatably mounted.

24
25 The shaft member 110 is of the form of a cylindrical
26 rod with a recess 112 removed around a portion of
27 the circumference of the shaft member 110 and along
28 that part of its length which is presented to
29 (above) the cylinder 12.

30
31 It is to be understood that the shaft member 110 and
32 recess 112 are presented facing the cylinder

12

1 irrespective of the cylinders orientation; for
2 example, it may be a horizontal engine, in which
3 case the recess 112 is presented adjacently facing
4 the cylinder 12.

5
6 The shaft member 110 is rotatably mounted in the
7 cylinder head D.

8
9 The shaft member 110 is parallel with, and is co-
10 operatively driven by, the crankshaft P by virtue of
11 connecting means (not shown) in the form of a belt
12 or gearing 114.

13
14 The recess 112 serves to allow an ingress or egress
15 of air/fuel mixture or exhaust gases to and from the
16 cylinder 12 upon rotation of the shaft member 110.

17
18 The depth and length of the recess 112 presented to
19 (above) the cylinder 12 can be of any design and
20 dimensions to allow optimum ingress and/or egress of
21 air/fuel mixture and/or combusted gases to and from
22 the cylinder 12; for example, the recess 112 may be
23 of uniform depth and length or may have varying
24 depths or lengths, or the recess 112 may also be of
25 the form of a helix, etc.

26
27 In operation, as shown in Fig. 2a and Fig. 7, there
28 is an inlet of air from an inlet manifold 116 which
29 is coupled to a carburettor/fuel injector (not
30 shown) to form an air/fuel mixture.

31

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13

1 The shaft member 110 is presented such that the
2 recess 112 faces the intake port C and the cylinder
3 12 to allow an ingress of air/fuel mixture.

4
5 Rotation of the crankshaft P, initially caused by a
6 starter motor (not shown) then subsequently by the
7 transfer of energy from the flywheel, causes contra-
8 rotation of the shaft member 110 by virtue of
9 contra-connecting means (not shown) being connected
10 to the crankshaft P and gearing 114 on the shaft
11 member 110.

12
13 Rotation of the crankshaft P will cause the piston M
14 to retract, drawing-in the air/fuel mixture through
15 the inlet port C, into the cylinder 12.

16
17 Meanwhile, as the piston M is retracted by virtue of
18 the rotating crankshaft P, the recess 112 of the
19 shaft member 110 will contra-rotate in unison.

20
21 As the piston M bottoms out, the rotating shaft
22 member 110 and recess 112 face the intake port C and
23 the cylinder head D. Thus preventing any ingress or
24 leakage of air/fuel mixture on the compression
25 stroke, as shown in Fig. 2b.

26
27 On the compression stroke, the piston M is extended
28 to compress the air/fuel mixture as the crankshaft P
29 and interconnected shaft member 110 similarly
30 rotate, as shown in Fig. 2c.

31

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1 The recess 112 faces the cylinder head D and the
2 exhaust port L.

3
4 A spark plug K (not shown for convenience in Figs.
5 2a-d), ignites the compressed air/fuel mixture in
6 the cylinder 12.

7
8 Alternatively, in a diesel engine, the heat caused
9 by compressing the air/fuel mixture alone will
10 result in combusted gases.

11
12 The resultant combustion causes the piston M to be
13 fired to a retracted position causing the crankshaft
14 P and shaft member 110 to rotate.

15
16 The recess 112 meanwhile, will rotate facing both
17 the exhaust port L and cylinder 12 to allow the
18 piston M to extend exhausting the combusted gases
19 out through the recess 112 into the exhaust port L.

20
21 Upon exhaustion of the combusted gases, rotation of
22 the crankshaft P will cause the recess 112 to rotate
23 and face the cylinder 12 and inlet port C to allow
24 the cycle to begin again.

25
26 As the rotation of the crankshaft P and shaft member
27 112 are rotating opposite to one another, this will
28 have a balancing effect which may reduce noise and
29 vibration of the engine 10.

30
31 In a second embodiment of the present invention, as
32 shown in Figs. 3a-d and Fig. 8, there is provided

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15

1 apparatus 200 in the form of a cylinder head
2 assembly comprising a cylinder head D having two
3 valve assembly replacement shaft members, namely, an
4 intake shaft member 210 and an exhaust shaft member
5 212 which are rotatably mounted.

6
7 The shaft members 210, 212 are of the form as
8 described above with recesses 214, 216 as also
9 described above.

10
11 The shaft members 210, 212 are rotatably mounted in
12 the cylinder head D as before.

13
14 The shaft members 210, 212 are parallel with, and
15 are co-operatively driven by, the crankshaft P by
16 connecting means (not shown) coupled to gearing 114.

17
18 Alternatively, the shaft may be belt driven from the
19 crankshaft P.

20
21 The recesses 214, 216 are as described above, and
22 serve to allow an ingress of air/fuel mixture and an
23 egress of combusted gases respectively, into the
24 cylinder 12 upon rotation of the crankshaft P and
25 shaft members 210, 212.

26
27 The depth and length of the recesses 214, 216
28 presented to (above) the cylinder 12 can be of any
29 design and dimensions to allow optimum ingress and
30 egress of air/fuel mixture and combusted gases to
31 and from the cylinder 12; for example, the recesses
32 214, 216 may be of uniform depth and length or may

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1 have varying depths or lengths, or they may be of
2 the form of a helix, etc.

3

4 In operation, as shown in Fig. 3a, the intake shaft
5 member 210 is rotated, by the crankshaft P, to face
6 the intake port C and the cylinder 12 to allow an
7 ingress of air/fuel mixture.

8

9 Meanwhile, the exhaust shaft member 212 faces the
10 exhaust port L and cylinder head D thus preventing
11 air/fuel mixture to leave the cylinder 12 or air to
12 enter therein.

13

14 As the air/fuel mixture enters the cylinder 12 from
15 the intake port C, the crankshaft P rotates causing
16 the piston M to retract, causing the shaft members
17 210, 212 and hence recesses 214, 216, to rotate in
18 unison by virtue of them being interconnected by
19 connecting means to the gearing 114.

20

21 As the piston M begins to extend, the recess 214
22 rotates to face the cylinder 12 and cylinder head D.
23 Thus preventing any ingress or leakage of air/fuel
24 mixture from the cylinder 12 on the compression
25 stroke, as shown in Fig. 3b.

26

27 Meanwhile, the exhaust shaft member 212 will
28 likewise have rotated with the recess 216 now facing
29 the cylinder head D completely. Thus preventing an
30 ingress of air or an egress of air/fuel mixture.

31

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1 On the compression stroke, the crankshaft P rotates
2 causing the piston M to extend compressing the
3 air/fuel mixture. The interconnected shaft members
4 210, 212 and recesses 214, 216 similarly rotate.

5
6 As the piston M becomes fully extended on the
7 compression stroke, the intake recess 214 at this
8 point completely faces the cylinder head D and is
9 thus closed off preventing any egress of compressed
10 air/fuel mixture, as shown in Fig. 3c.

11
12 A spark plug K (not shown for convenience in Figs.
13 3a-d), ignites the compressed air/fuel mixture in
14 the cylinder 12.

15
16 Alternatively, in a diesel engine, the heat caused
17 by compressing the air/fuel mixture alone will
18 result in combustion.

19
20 The resultant combustion causes the piston M to be
21 fired to a retracted position causing the crankshaft
22 P and shaft members 210, 212 to rotate.

23
24 The intake recess 214 will rotate facing both the
25 cylinder head D and the intake port C.

26
27 The exhaust recess 216 will rotate facing the
28 cylinder 12 and exhaust port L to allow an egress of
29 combusted gases, as shown in Fig. 3d.

30

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18

1 The piston M then extends exhausting the combusted
2 gases out through the recess 216 into the exhaust
3 port L by virtue of the rotating crankshaft.

4
5 Meanwhile, rotation of the crankshaft P will cause
6 the intake recess 214 to rotate and face the inlet
7 port C and the cylinder 12 to allow the cycle to
8 begin again.

9
10 The exhaust recess 216 will likewise rotate facing
11 the exhaust port L and the cylinder head D, as shown
12 in Fig. 3a.

13
14 In a third embodiment of the present invention there
15 is provided apparatus 400, as shown in Figs. 5 and
16 9, having apparatus 200 as previously described in
17 the second embodiment, wherein the intake shaft
18 member 210 and the exhaust shaft member 212 are of
19 the form of a hollow cylindrical intake shaft member
20 410 and a hollow cylindrical exhaust shaft member
21 412.

22
23 In this way, it should be realised that the heavy
24 intake manifold (not shown) and outlet manifold 116,
25 can be replaced by single, less heavy and
26 complicated manifolds 418, 420, which allow the
27 ingress of air/fuel mixture and egress of combusted
28 gases through the hollow shaft members 410, 412.

29
30 The shaft members 410, 412 are presented to (above)
31 the cylinder 12 to allow an ingress of air/fuel
32 mixture thereto through aperture 414, and an egress

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1 of exhaust gases therefrom through aperture 416.

2

3 In this third embodiment, the air/fuel mixture
4 passes through the hollow intake shaft member 410
5 and exits through the aperture 414 into the cylinder
6 12.

7

8 After the compression and combustion strokes, the
9 exhaust gases exit the cylinder 12 through the
10 aperture 416 and leave via the hollow exhaust shaft
11 member 412.

12

13 The shaft members 410, 412 are connected to the
14 crankshaft P by connection means (not shown) coupled
15 to gearing 114.

16

17 Alternatively, the shaft members 410, 412 may be
18 coupled to the crankshaft P by a belt.

19

20 It is conceived that rotation of the shaft members
21 410, 412 although specifically described as being
22 coupled to and controlled by the crankshaft P, may
23 be independently controllable adjustable.

24

25 Furthermore, both shaft members 410, 412 may be
26 driven independently from the crankshaft P and of
27 each other.

28

29 In a fourth embodiment of the present invention,
30 there is provided apparatus 200 wherein the shaft
31 members 210, 212 are of the form of hollow shaft
32 members 300, as shown in Figs. 4a and 4b.

1 Each shaft member 300 has an inner hollow
2 cylindrical tube 310, rotatably mounted within an
3 outer hollow cylindrical tube 312, also rotatably
4 mounted.

5
6 The tubes 310, 312 have apertures 314, 316 which
7 correspondingly serve to allow an ingress of
8 air/fuel mixture and egress of exhaust gases to pass
9 therethrough.

10
11 The apertures 314, 316, when appropriately aligned,
12 form a passage 326.

13 The area of the passage 326 is adjusted and
14 controlled by the speed of rotation of the tubes
15 310, 312 relative to one another.

16
17 Rotation of the tubes 310, 312 is controlled by
18 gears 318, 320 located around the circumference of a
19 cylindrical buttressed end 322 of the tubes 310,
20 312.

21
22 Rotation of the tubes 310, 312 may be coupled to the
23 crankshaft P with independently controllable/
24 adjustable means for varying the speed of rotation
25 of the tubes 310, 312.

26
27 Alternatively, both tubes 310, 312 may be driven
28 independently from the crankshaft P and of each
29 other, with controllable/ adjustable means for
30 varying the speed of rotation of the tubes 310, 312.

31
32 It will be recognised that the tubes 310, 312 may

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1 also be belt driven or the such like, independently,
2 or coupled to, the crankshaft P.

3
4 The speed of rotation of the inner tube 310,
5 relative to the outer tube 312, is such that the
6 area of the passage 326 maximises or restricts the
7 rate of ingress or egress of air/fuel mixture or
8 exhaust gases. In this way, the rotatable shaft
9 members 300 offer a variable valve timing and
10 variable valve size.

11
12 With reference to Figs. 4a and 4b, it is to be
13 understood that both tubes 310, 312 do not move
14 horizontally/longitudinally. The apertures 314, 316
15 share a common centre-line C/L, and are shown offset
16 for illustrative purposes only.

17
18 Common to all embodiments and with regard to sealing
19 of the various shaft members 110, 210, 212, 310,
20 312, 410, 412 of the present invention, these will
21 be as tight a fit as possible cognisant of the
22 expansion of materials of the individual,
23 respective, components that will occur once the
24 engine reaches working temperature.

25
26 The shaft members 110, 210, 212, 310, 312, 410, 412
27 include gas tight seals (not shown) incorporated on
28 the outside faces of bearing races (not shown), of
29 support bearings (not shown), that will be spaced
30 along the rotating shaft members 110, 210, 212, 310,
31 312, 410, 412 between the cylinder 12.

32

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1 Gas tight paddles (not shown) are located within
2 apertures (not shown) of the shaft members 110, 210,
3 212, 310, 312, 410, 412, at either side of the
4 respective recesses and apertures 112, 214, 216,
5 314, 316, 414, 416, of the axis of rotation.

6
7 Springs (not shown) are located at the base of the
8 paddles within the apertures. These serve to force
9 the paddles outwards towards and against the inside
10 surfaces of the cylinder head D, within which the
11 shaft members rotate, so ensuring a gas tight seal
12 in a similar way to the WANKEL rotary engine.

13
14 Common to all embodiments, it should be realised
15 that the shaft members 110, 210, 212, 310, 312, 410,
16 412 may be of the form of extended or adapted shaft
17 members 510, 512, rotatably mounted, with a
18 plurality of recesses or apertures 514, 516
19 corresponding to the number of cylinders 12, as
20 shown in Fig. 6.

21
22 Furthermore, the recesses 112, 214, 216 and
23 apertures 314, 316, 414, 416 of the corresponding
24 shaft members 110, 210, 212, 310, 312, 410, 412 can
25 be as wide as the diameter of the cylinder 12 above
26 which they sit. This means that a far greater area
27 will be available for an ingress of air/fuel mixture
28 or egress of exhausted gases, than might be
29 associated with conventional valves.

30
31 The hollow intake shaft members (310, 312,) 410, 510
32 may form an integral part of an inlet system (not

1 shown), or may feed into, much simplified, single
2 branch manifolds 418, at the respective open end of
3 the shaft members (310, 312), 410, 510 at an end of
4 the cylinder head D.

5
6 The hollow exhaust shaft members (310, 312), 412,
7 512 may form an integral part of an exhaust system
8 (not shown), or may feed into, much simplified,
9 single branch manifolds 420, at respective open ends
10 of the shaft members (310, 312), 412, 512 at an end
11 of the cylinder head D.

12
13 In this way, the air/fuel mixture and exhaust gases
14 would not be required to travel via individual
15 openings within the cylinder head D to individual,
16 heavy, complicated, and expensive multiple branches
17 of intake/exhaust manifolds, feeding the
18 intake/exhaust ports C, L to each cylinder 12.

19
20 The present invention as described, has a reduced
21 size compared to a conventional engine 10 and offers
22 greater flexibility to the location, installation,
23 and utilisation of internal combustion engines.

24
25 The simpler design will have favourable implications
26 as to complexity, overall size of the engine,
27 efficiency, noise and reliability, finance of raw
28 materials, manufacturing, etc.

29
30 For the sake of clarity, it should be understood
31 that fuel injectors/carburettors, and the spark
32 plug, have been omitted from Figs. 2a-d and 3a-d but

1. may be part of the cylinder head assembly.
- 2
3. Modifications and improvements may be made to the
4. above without departing from the scope of the
5. present invention.

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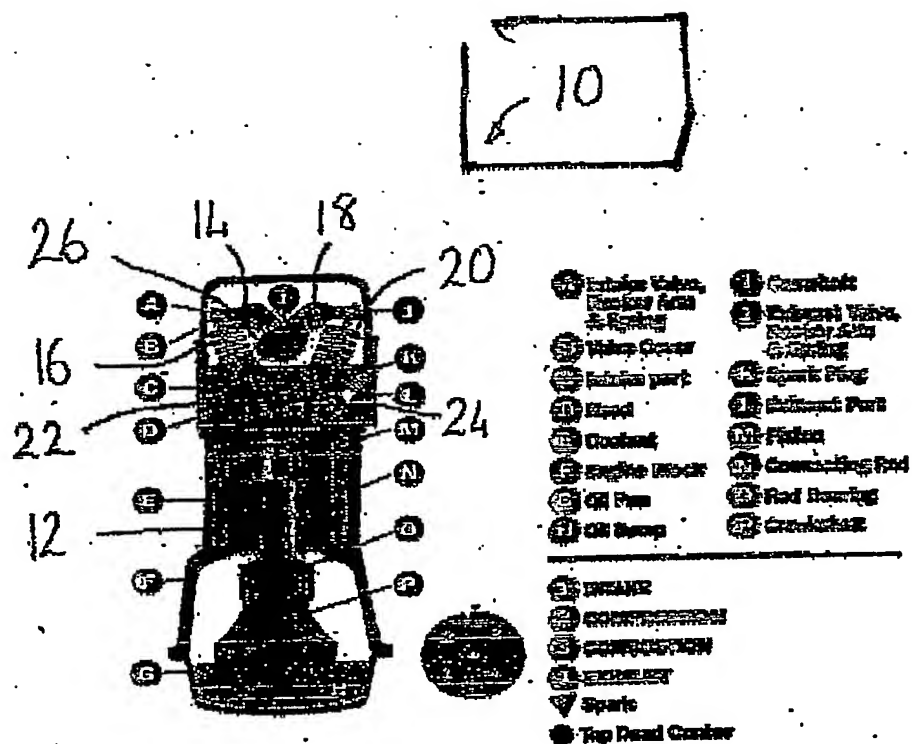
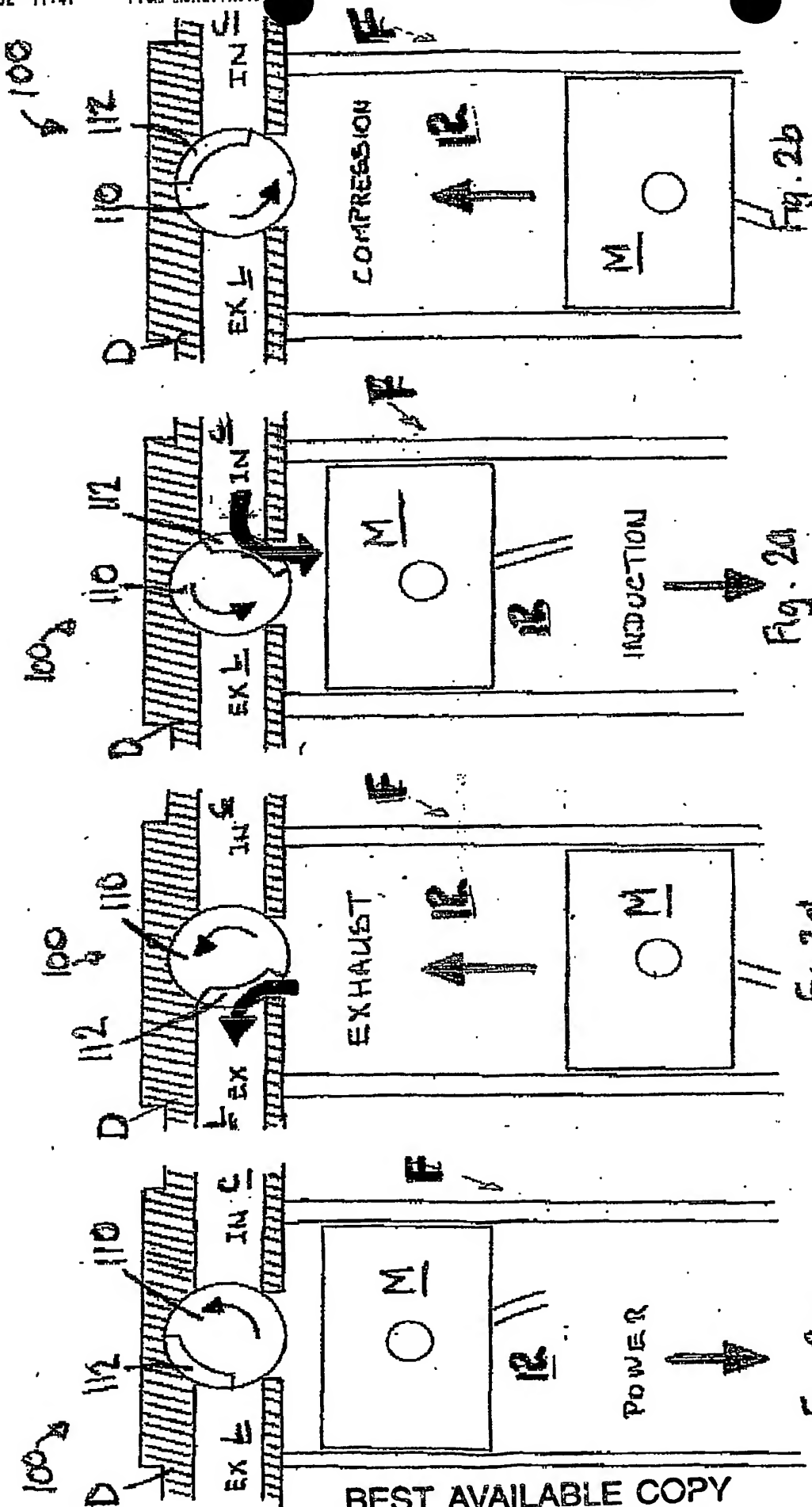


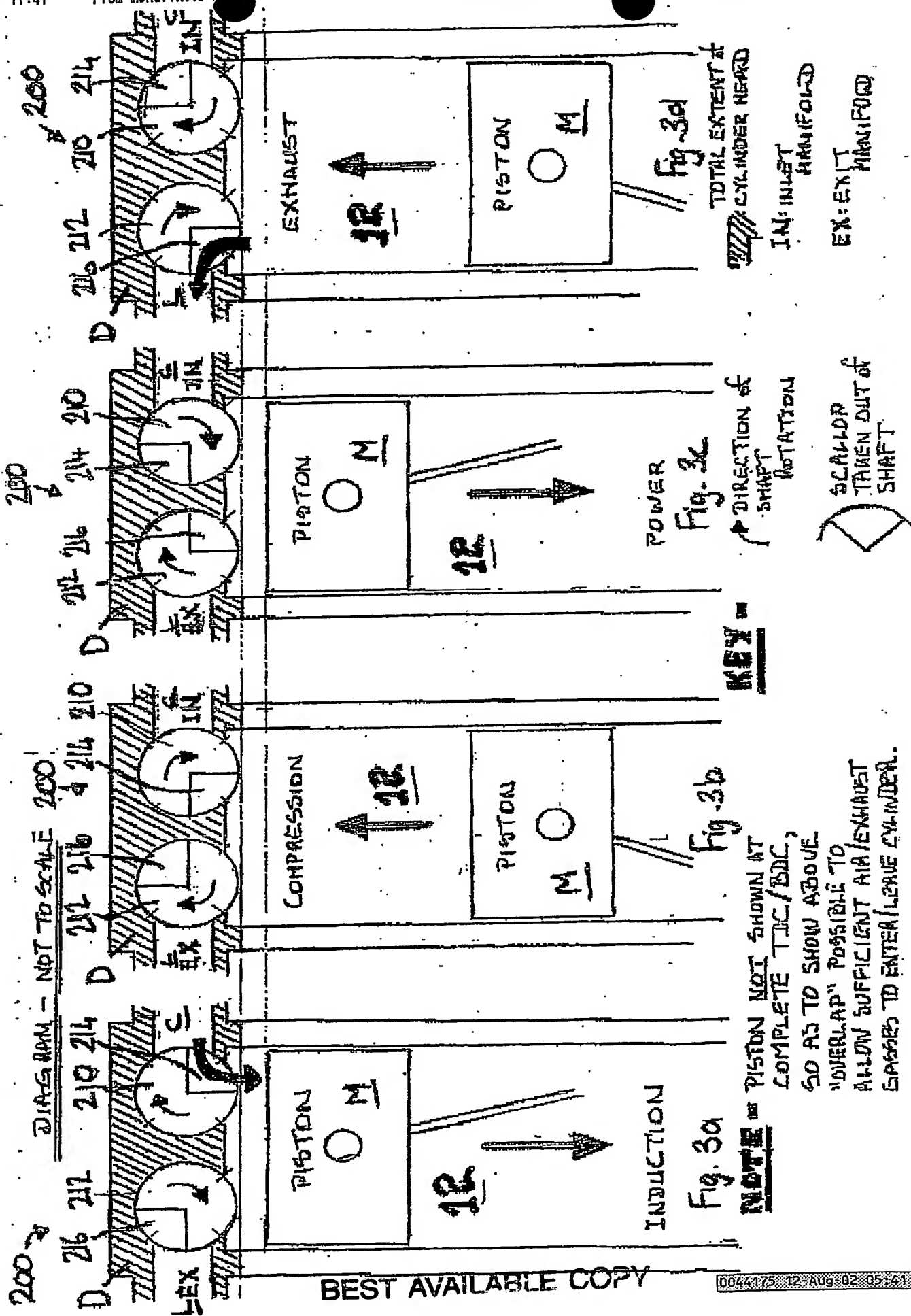
Fig. 1

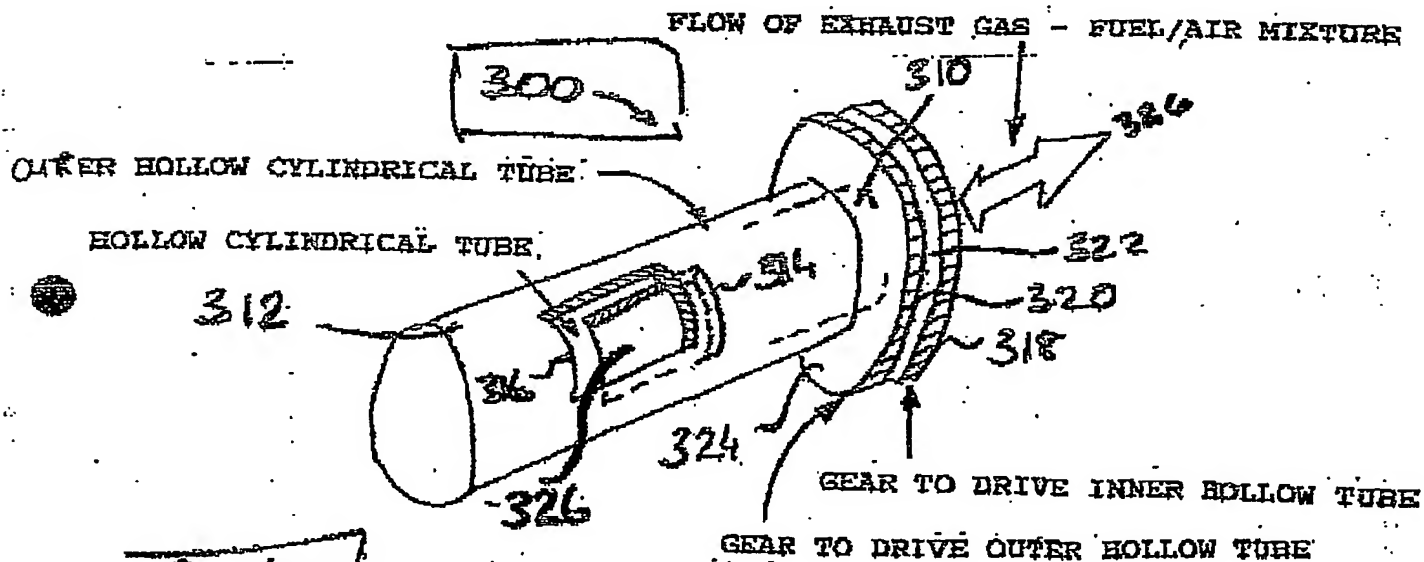
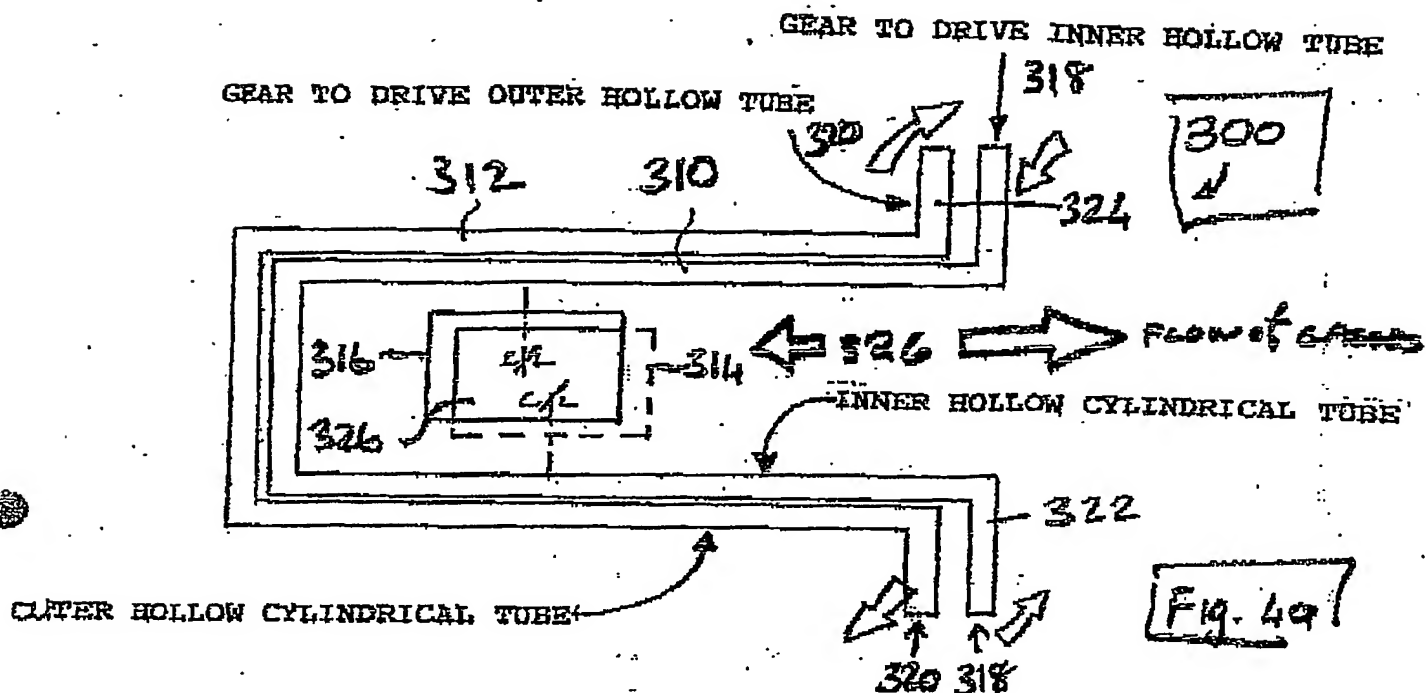
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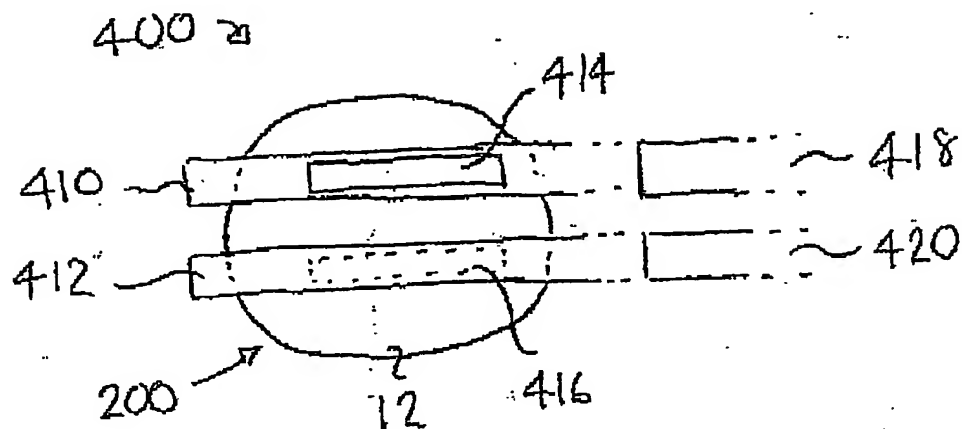


Fig. 5

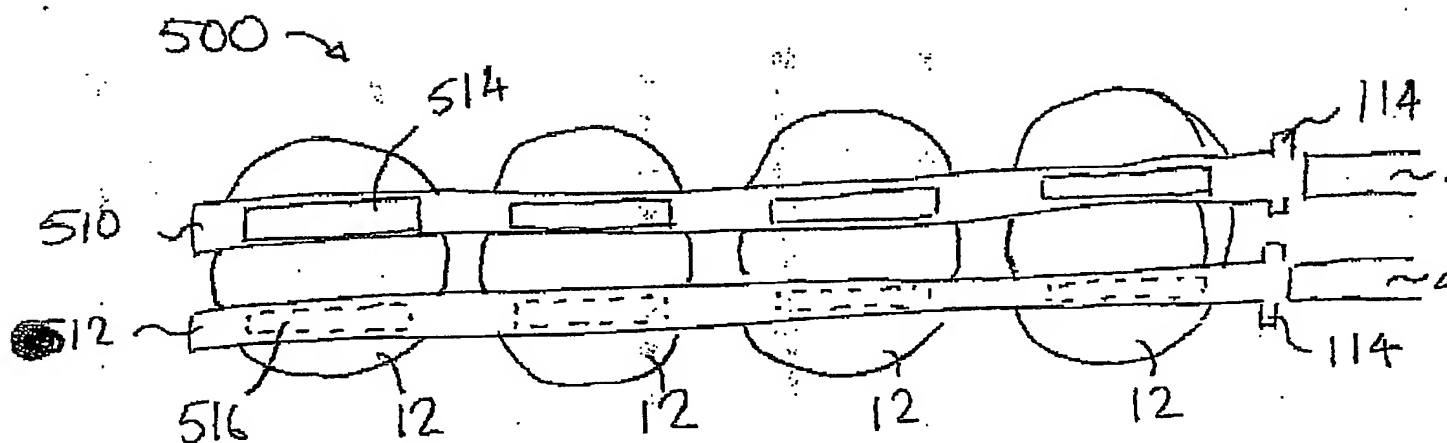
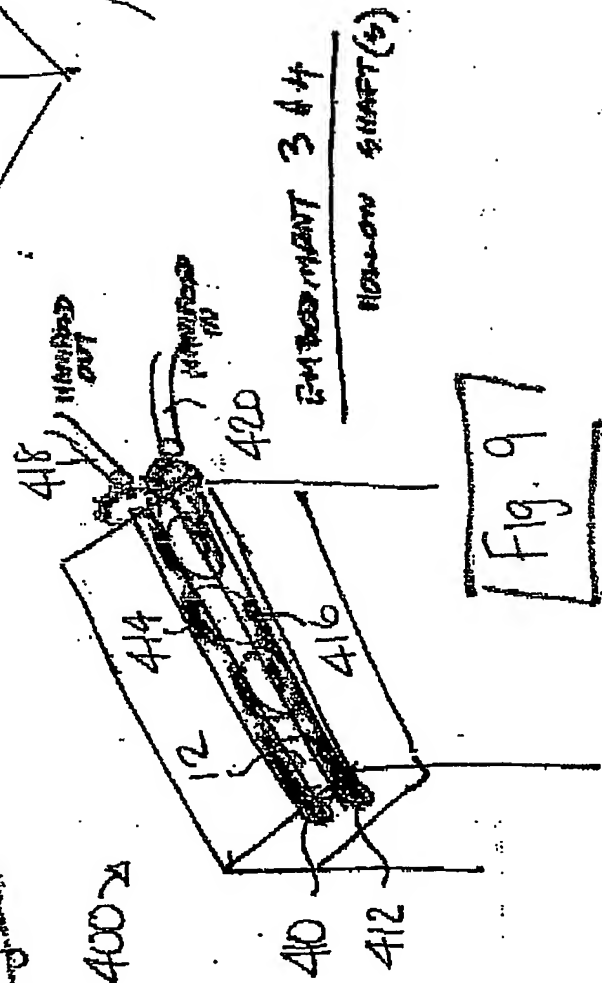
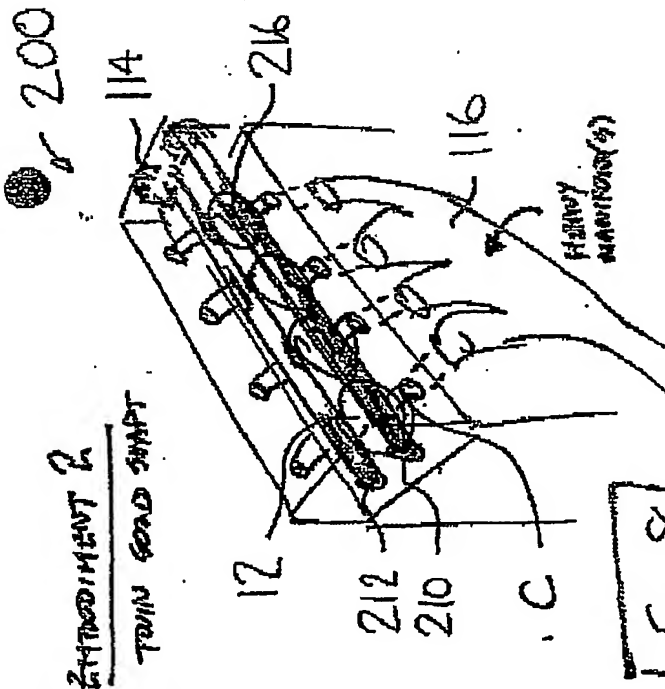
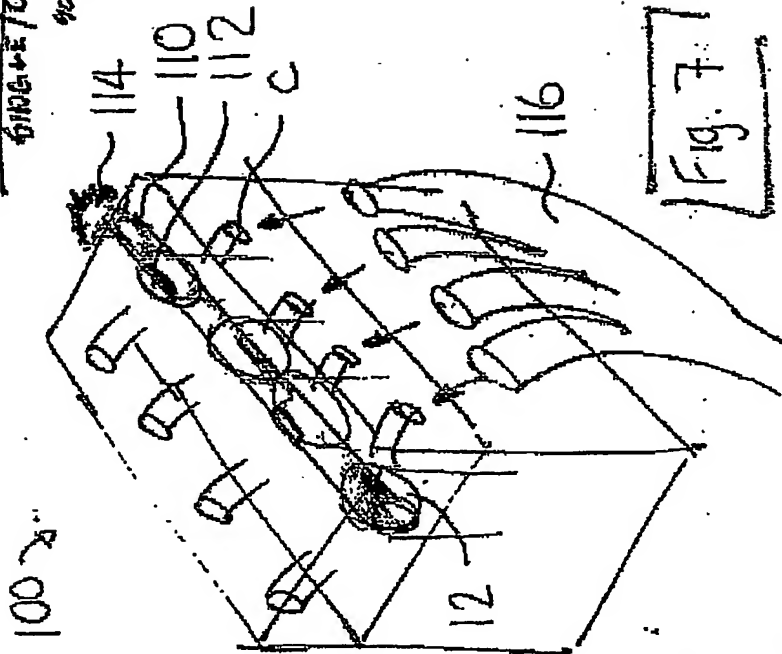


Fig. 6

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EMBEDMENT 1
GIGGLE/CONTRA-ROTATING
SOLID SHAFT



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